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# Research Briefs

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## Inside



## Nutrition and Health

**Excess body fat** appears to build up from too little physical activity rather than too many calories, researchers concluded. In studies of two groups of sedentary men—one group in their 20s and another over 65—there was no relationship between the men's body fat levels and their calorie intake. There was, however, a significant inverse relationship with physical activity: Those who engaged in the least physical activity had the most fat. Both groups ate significantly more calories each day than currently recommended and burned significantly more. These findings support evidence that the current RDAs for energy (calories) significantly underestimate actual requirements. The older men, for instance, burned an average 2,800 calories daily compared to the 2,400-calorie RDA. That's because their physical activity was significantly higher than the value used to calculate the RDA even though they did not exercise on a regular basis. The new data will help health professionals reassess the adequacy of food intake for different populations and also allow USDA to fine-tune its food aid based on how many calories individuals actually eat. The data also provide a more accurate basis for setting weight reduction diets. The 1,500-calorie diet typically recommended for men is a bigger cut in calories than previously thought.

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**Blood lipid abnormalities** were found in more than half the families of coronary artery disease patients under age 60. The study of 102 families emphasizes the need to screen all blood relatives, especially children, of premature coronary artery disease patients. Low HDL cholesterol—the good kind—was the most common abnormality. One out of three families had HDL in the lowest 10 percent, indicating that its absence is a prime risk factor for heart attack. Most of these low-HDL families also had either high triglycerides or high triglycerides and high LDL cholesterol, the bad kind. One out of five families had an excess of Lp(a)—another lipid-carrying particle that is gaining attention as a risk factor for heart disease. It was the only lipid abnormality in more than half of the cases. Very few families—one out of 20—had high triglycerides or high LDL alone. The findings underscore the need for physicians to focus more attention on treating people with low HDL and other lipid changes instead of targeting high LDL symptoms.
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**Chubby young girls** are not destined to become obese middle-age women, nor are skinny young girls assured of staying slim. A study of 50 years of height and weight data shows that childhood obesity in females does not predict obesity at age 40 or 50 as it does in males. The findings do not support putting overweight young girls on diets to prevent obesity later in life, says the study leader. Females go through many body changes starting at puberty when they have a marked increase in body fat. Some may thin out due to their adolescent growth spurt, while others may begin a history of dieting at this time. Researchers analyzed height and weight measurements of 91 men and women in the Harvard Longitudinal Studies of Child Health and Development and found no correlation between females' body mass index (BMI) at age five to seven years and at middle age. BMIs—weight divided by height squared—in early adolescence were good predictors of their relative weights at age 40. But not until the young

women reached 18 did their BMIs correlate well with those at age 50. By contrast, the males' BMIs at all ages—childhood, adolescence and young adulthood—were more reliable in predicting body size in middle age.
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**An overweight teenage male** has twice the risk of dying earlier than a lean male. And overweight teenagers of both sexes have a higher risk of serious disease before age 73. These risks don't depend on one's weight in middle age, according to a recent follow-up study of 508 men and women who participated in the 1922-35 Harvard Growth Study from first grade through high school. Those in the top 25 percent for weight in their teens were twice as likely to have been diagnosed with coronary heart disease, seven times more likely to have atherosclerosis, and nearly three times more likely to have gout by age 73 than their leaner peers. Excess teenage weight also increased the risk of colorectal cancer in men by six times and doubled the risk of arthritis in women. The researchers interviewed those Harvard study participants who were still living and could be reached after 55 years, and obtained dates and causes of death for the deceased. They also used height and weight data from a mid-life follow-up in their analysis to see if it influenced risk. Middle-age weight status did not change risk significantly. This doesn't mean that middle-aged people can ignore excess weight; it's still an important risk factor. But the study emphasizes that successful treatment of excess weight in adolescence may prevent a significant proportion of adult disease and death attributed to obesity.
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**Beta carotene's reputation** for preventing cancer may be due partly to the body's ability to convert it into retinoic acid. This vitamin A relative is being successfully used in cancer treatment programs here and abroad. But it's quite toxic to tissues, so the body breaks it down quickly. Now, studies of cultured human and animal cells and of ferrets—which metabolize beta carotene much the same as people do—show that intestinal cells themselves convert a small portion of beta carotene into retinoic acid and other vitamin A-related compounds. These compounds are absorbed by the cells and move into circulation slowly to prevent toxic levels. The studies also found that lung, liver, kidney and fat tissues can convert beta carotene into retinoic acid and its relatives. This suggests that we can raise levels of retinoid acid in body fluids or tissues by eating more foods high in beta carotene, which is not toxic even in fairly large doses. Orange and yellow fruits and vegetables and dark green leafy vegetables are rich in beta carotene and other carotenoids.
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**Eating more carbohydrates** did not improve the endurance or strength of men who exercise moderately—unlike the payoffs for marathoners and other athletes who train long and hard. Eighteen men in their 20s and 30s were tested after eating both high and low carbohydrate diets. A third of the men were sedentary. The other two groups either ran (aerobic exercise) or lifted weights (strength training) three to four times a week for an hour or less. After three weeks of getting 62 percent of their calories as carbohydrates, none of the volunteers could pedal a stationary bicycle significantly longer than when they got 42 percent carbohydrates. Nor could their leg muscles overcome any more resistance or their upper bodies bench-press any more weight. Both runners and weight lifters burned significantly more calories per day than the sedentary group. The runners averaged 14 percent more calories daily; the weight-lifters, who trained the hardest, averaged 21 percent more. The findings underscore that people who exercise regularly can eat more calories than sedentary people and still maintain a healthy weight. On the other hand, eating more carbohydrates probably won't improve performance during such exercise. But it cuts down on fat intake, and that's beneficial for everyone.
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**Copper deficiency** explains why people who regularly use zinc supplements have a drop in the "good" HDL cholesterol. Pigs exposed to excessively high zinc during gestation and afterwards had a mild copper deficiency even though they and their mothers got adequate copper throughout the study. In several studies, copper deficiency has produced adverse cholesterol changes in people and animals. And it's well known that excess zinc interferes with copper metabolism and vice versa because the two metals are similar in their chemical properties. So researchers wanted to test whether the drop in HDL cholesterol that was attributed to high zinc was actually due to copper deficiency induced by high zinc. They used pigs because their circulatory and digestive systems are similar to those of humans. The result: Animals exposed to excessive zinc—about 33 times normal—had lower HDL

cholesterol and less copper in the blood and heart muscle than the controls. Moreover, heart muscle tissue showed the same abnormalities under the electron microscope as animals fed a copper-deficient diet. Unlike these pigs, most people eating diets of Western countries don't get the recommended amount of copper. So indiscriminate use of zinc supplements should be discouraged because of the potential for cardiovascular harm.
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*Grand Forks, ND*
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*Children's Nutrition Research Center, Houston, TX*
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**More evidence** that the immune system depends on an adequate intake of copper to operate at peak performance comes from a study of T cells from rats. The new study shows that T cells—lymphocytes that orchestrate the cellular response to invading organisms—need this essential trace element to respond optimally. Researchers compared T cells from the spleen of rats raised on copper-deficient diets with those from a control group that were fed ample copper. When activated with standard antigens, T cells from the copper-deficient rats had a markedly lower degree of DNA synthesis, which is necessary for cell division. Addition of copper to the copper-deficient T cells enhanced DNA synthesis by increasing the cells' secretion of interleukin-2, which is required for T cell division.
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**A hormone** that sterilizes female mosquitoes and other blood-sucking insects in laboratory studies offers a possible new way of controlling the pests outdoors. A synthetic chemical mimic of the oostatic hormone, injected into female mosquitoes, prevented up to 98 percent of their eggs from forming. The hormone can also be fed to mosquitoes to interrupt egg development. It is only present during certain times in the insect's life cycle. If the hormone is put into the mosquito at the wrong time, it blocks the production of enzymes that female mosquitoes need to develop their eggs. The same reaction happens in biting midges, flies and fleas. The discovery of the hormone opens the way to inserting the hormone-producing gene in a mosquito parasite called a spiroplasma, which could then be sprayed or applied in some other way on mosquitoes in the field. It's part of an ongoing effort to find new ways to control harmful insects without using agrichemicals.
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## Food Freshness and Safety

**Edible films**, coatings and other plastic-like products made from soy protein could extend the shelf life of fruits, vegetables, meats and packaged foods. This new substitute for synthetic petroleum-based plastics helps reduce environmental pollution. Soy-protein coatings can prevent the loss of moisture and oxygen, which could be useful in maintaining the original flavor of foods. They could be particularly important to precooked meat products, preventing them from developing rancid off-flavor known as warmed-over flavor. The proteins can be mixed with various ingredients and additives before being cast into films or coatings for food products. And, by using enzymes and other treatments, the protein can be modified for coatings and films with various uses.
*Food and Feed Processing Research, New Orleans, LA*
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**Dole Associates of Katonah, NY,** has been licensed to commercialize an ARS-developed test that detects harmful strains of a food poisoning organism without killing them. This test for *Y. enterocolitica* is important when initial results of field tests need to be confirmed. It enables scientists to recover the live bacterium from food and food processing equipment, water and sewer treatment facilities then grow it in the lab for identification and verification. Current tests kill the bacterium. The Food and Drug Administration recently used the technology to detect harmful strains of the pathogen in Los Angeles County. USDA's Food Safety and Inspection Service is training personnel how to use the test. *Y. enterocolitica* can grow at refrigerator temperatures, but the genes that mark it as a disease-causing strain are expressed only at body temperature. So, all tests require incubation at 98.6 degrees F to detect harmful strains. Incubation longer than 12 hours, however, causes the organism to lose its disease-causing genes and makes it appear to be a harmless strain.
*Eastern Regional Research Center, Philadelphia, PA*
*Saumya Bhaduri, (215) 233-6521*

**When is beef flavor at its peak?** ARS scientists say it's usually four to five days after slaughter depending on the cut of beef. After that, BMP—for "beefy meaty peptide"—begins to naturally break down. More knowledge of this peptide could lead to a commercial version of BMP as a food additive. It not only gives meat the greatest degree of beefy flavor, but offers a valuable source of nutritional protein. Peptides, which are small units of proteins, are chains of amino acids. Individual amino acids have different tastes—some sweet, sour or bitter. BMP, which has eight amino acid links, loses its beefy meaty flavor and develops a bitter

or sour taste, as amino acids are removed by enzymes during aging. Researchers are also looking for the parent protein of BMP. Once identified, it may be possible to breed cattle that will produce more beefy-flavored cuts. And information on BMP's origin could help the meat industry understand what methods need to be used at slaughter to stimulate BMP production.
*Southern Retional Research Center, New Orleans, LA*
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**Sticky clumps of spaghetti** may become a thing of the past, thanks to a test developed by ARS and North Dakota State University scientists to routinely monitor product quality. When spaghetti is sticky, chances are it was made from starch-damaged semolina—which is coarsely ground durum flour. Adapting a commercially available testing instrument, the scientists can predict stickiness in spaghetti made from different wheat varieties by checking for higher-than-normal amylose and sugars in semolina, cooked or uncooked spaghetti or cooking water. Their studies showed spaghetti is likely to have too much starch damage if the wheat was sprouted, the semolina was too finely ground or the spaghetti was overcooked. Researchers also found that mixing a type of fat called monoglyceride into spaghetti during processing decreased stickiness if the spaghetti was quickly dried at 148 degrees F.
*Cereal Crops Research, Fargo, ND*
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**Spraying citrus trees with abscisic acid**—a commonly used growth regulator—and other compounds will help protect Florida's crop from freeze damage. These compounds allow young, immature trees to supercool more deeply and survive at temperatures around 22 degrees F. Supercooling is the way plants protect themselves from freeze damage by keeping the temperature of internal cellular water below freezing. Young trees treated with the compounds have survived what normally would be a lethal freeze for up to two hours. The trees showed no injury and there was no evidence of ice forming in plant tissues.
*U.S. Horticultural Research Laboratory, Orlando, FL*
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**Corn earworm larvae** can't develop normally when fed certain natural plant chemicals. One of these chemicals, precocene II, impairs a larva's ability to digest and assimilate nutrients. ARS scientists are studying plant compounds such as precocene II that might serve as models for manufacturing "natural" pesticides. One strategy may be to genetically engineer crop plants to produce biopesticides harmful to a marauding insect. The corn earworm is one of the most destructive pests of several U.S. crops including corn, cotton and tomato.
*Corn Insects Research, Ames, IA*
*Bradley F. Binder, (515) 294-6948*

**A virus** that's ravaging European orchards could meet its match in a gene being tested in 36 U.S. plum trees. Plum pox virus is not present in this country but is one of the most serious diseases of plums and apricots in Europe. Researchers have inserted a gene that codes for a piece of the protein surrounding the papaya ringspot virus. They hope to see the protein produced in the plum trees. Such protein genes have been used in other crops to successfully protect them against other viruses. The potential increase of travel and exchange of goods between the United States and Eastern Europe and the former Soviet Union heightens the risk of plum pox virus striking U.S. orchards. This disease is a potential threat to stone fruit production and a major concern of plant quarantine agencies in the United States. The experimental trees were planted at Kearneysville, WV, in November 1992.
*Appalachian Fruit Research Station, Kearneysville, WV*
*Ralph Scorza, (304) 725-3451*

**The use of fungi and sex attractants** as new, nature-based commercial controls for soybean cyst nematodes has been licensed to Crop Genetics International of Hanover, MD. The wormlike pests stole $250 million in soybean yields from U.S. growers in 1991. But ARS scientists invented two strategies that could give farmers safe, effective options to chemical nematicides, some of which have been banned as environmental hazards. One new control is a mutant strain of *Verticillium lecanii* fungus that destroys more nematode eggs than strains found in nature. Another strategy prevents nematodes from mating—the males get sidetracked by compounds that mimic females' sex attractant, or pheromone. Joint use of fungi and a pheromone-like compound—released from pellets placed in the soil—cut nematode numbers as much as 86 percent in field tests. ARS is running tests under a cooperative research and development agreement with the company.
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The **Briefs** is published quarterly by ARS Information. For further information or addition to the mailing list, contact Judy McBride, nutrition editor, at (301) 504-8932; or write me at Bldg. 419, BARC-East, Beltsville, MD 20705.